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(54) A soil cultivating machine.

(57) A soil cultivating machine (2) comprising a frame, soil working members and a roller (4) which extends through approximately the full working width of the machine (2), the roller (4) being assembled from a plurality of roller elements (18) of a length considerably less than half the length of the roller (4), and which elements are rotatable about a shaft which is arranged at an angle to the longitudinal direction of the roller (4).

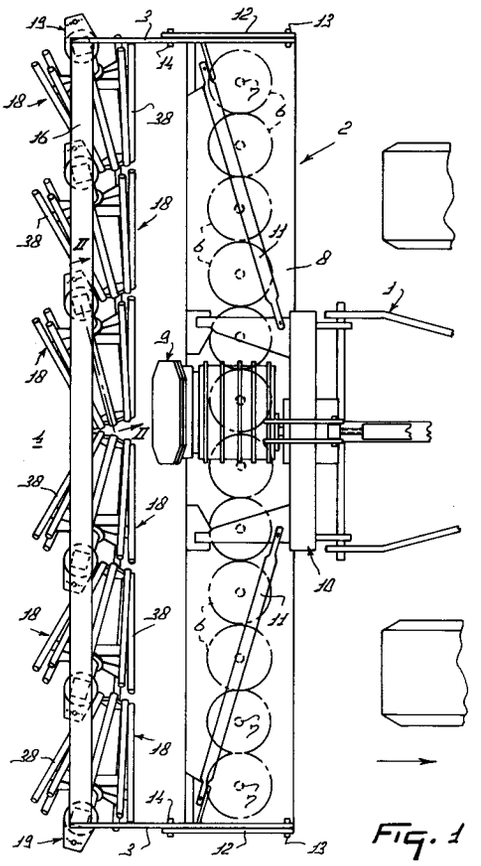

FIG. 1

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The present invention relates to a soil cultivating machine comprising a frame, soil working members and a roller which extends through approximately the full working width of the machine. Soil cultivating machines of this type are known. With these machines, the axis of rotation of the roller usually extends transversely to the direction of operative travel, so that the roller rolls without friction. Earth may then stick to the roller, so that scrapers are required to keep the roller free from adhering earth.

The present invention has for its object to provide a roller to which the earth will stick less easily. According to the invention, this can be achieved by assembling the roller from a plurality of elements of a length which is considerably less than half the length of the roller, and which elements are rotatable about a shaft which is arranged at an angle to the longitudinal direction of the roller. In accordance with a specific feature of the invention, it is then advantageous when one or more roller elements are mounted adjustably and lockably about an upwardly directed axis. The invention, therefore, also relates to a soil cultivating machine comprising a frame, soil working members and a roller which extends through the full working width of the machine, the roller being assembled from a plurality of individual roller elements mounted adjustably and lockably about an upwardly directed axis. This construction enables an adequate adaptation to different circumstances. A still further specific feature of the invention is the characteristic that the roller has a circumferential surface formed from plate material. Using such a circumference, the roller remains advantageously clean.

The invention, therefore, also relates to a soil cultivating machine comprising a frame, soil working members and a roller which extends through approximately the full working width of the machine, wherein the roller has a circumferential surface formed from plate material and is rotatable about a rotary shaft arranged obliquely with respect to the direction of operative travel.

In a further advantageous embodiment, the machine in accordance with the invention includes a roller having a circumferential surface which is mainly formed by rod-like or tubular elements. The roller surface with rod-like elements provides that the roller rotates in an advantageous manner, while the roller remains clean and the soil surface is advantageously worked at the same time. The invention, therefore, also relates to a soil cultivating machine comprising a frame, soil working members and a roller which extends through approximately the full working width of the machine, wherein the roller has a circumference which is mainly formed by rod-like or tubular elements and wherein the roller is rotatable about a rotary shaft arranged obliquely with respect to the direction of operative travel.

In accordance with the invention, the effects mentioned in the foregoing are expressed in a particularly good manner when the roller comprises a plurality of roller elements, each in the shape of a truncated cone. When a truncated roller element is in contact with a soil surface via the full length of the lowermost peripheral part, then, because of the different peripheral lengths near the ends of a roller element, friction with the soil surface is produced, which counteracts adherence of earth. The invention, therefore, also relates to a soil cultivating machine comprising a frame, soil working members and a roller which extends through approximately the full working width of the machine, the roller being assembled from a plurality of roller elements, each in the shape of a truncated cone. In accordance with the invention, an advantageous array of the roller elements is further obtained, when, seen in plan view, the roller elements each have a leading peripheral line which extends transversely to the direction of operative travel A of the machine. The invention, therefore, also includes a soil cultivating machine comprising a frame, soil working members and a roller which extends through approximately the full working width of the machine, the roller elements, seen in plan view, each having a leading peripheral line which extends transversely to the direction of operative travel A of the machine. In accordance with a further advantageous feature of the invention, the roller has a diameter of approximately 40 cms and, in operation, the soil cultivating machine is supported at least partly by the roller. The above-described roller construction has a particularly advantageous effect when the soil cultivating machine is a p.t.o.-driven rotary harrow.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a plan view of the machine in accordance with the invention in the state in which it is coupled to the lifting hitch of a tractor;

Figure 2 is a view of a roller element, taken on the line II-II in Figure 1;

Figure 3 is a view of a roller element, taken on the line III-III in Figure 2;

Figure 4 is, on a smaller scale, a view of a roller element, taken on the line IV-IV in Figure 2;

Figure 5 is a rear view of a portion of a second embodiment of the roller in accordance with the invention;

Figure 6 is a plan view of a detail of an embodiment of the machine, in which the roller elements are provided such that they are jointly

adjustable;

Figure 7 is a side view in the direction of the arrow VII in Figure 6, and

Figure 8 is a plan view of a still further embodiment of the roller, wherein the roller elements can jointly be adjusted.

In the drawings, corresponding components have been given the same reference numerals. In addition, the invention is in no way limited to the embodiments depicted and described here; they only serve to illustrate the inventive idea.

Figure 1 shows, coupled to the lifting hitch 1 of a tractor, a disc harrow 2, alternatively denoted p.t.o-driven rotary harrow, to the rear side of which a roller 4 is coupled via a pair of arms 3. The p.t.o-driven rotary harrow 2 is a known per se soil cultivating implement for the secondary soil working operation and, in the present embodiment which has a width of 3 metres, comprises twelve soil working members which are in meshing contact via gear-wheels 6 and are rotatable and drivable about upwardly directed shafts 7. The gear-wheels 6 are accommodated in a box-like frame 8 of the p.t.o-driven rotary harrow and are provided on the upper end of the upwardly directed shafts 7 which extend through the bottom of the frame and are bearing-supported with respect to the frame 8. One of the two centre-most shafts 7 also extends through the upper side of the box-like frame 8 into the interior of a gearbox 9 which is mounted on the frame and whose outgoing stub axle may be coupled, for the purpose of driving the soil working members, to the power take-off shaft of a tractor via a coupling shaft. The machine is provided with a trestle 10 which is arranged in the midway point on the upper side of the frame 8 for coupling to the three-point lifting hitch 1 of a tractor. So as to make the machine more rigid, the upper side of the trestle is connected to the ends of the box-like frame 8 via struts 11. The box-like frame 8 is closed at both ends by an upwardly directed plate 12, which extends to above the frame and to which the arms 3 are pivotably connected. The connection consists of a pivot shaft 13 which is passed through the end plate at the upper side of the frame 8. The height of the frame relative to the roller 4 is adjustable by means of a locking pin 14 which can be inserted into any one of a plurality of apertures at the rear side of the machine.

Between the rear ends of the two arms 3 there extends, in the longitudinal direction of the roller 4 and at a square angle to the direction of operative travel A, a carrier 16 formed by a hollow beam having a square profile. The roller 4 includes two mirror-inverted halves, each having three roller elements 18 which are attached to the carrier 16 via upwardly directed supports 17 and each extend from their support 17 predominantly towards the imaginary roller centre line located in the direction of operative travel. The roller elements 18 are in the shape of truncated cones and are provided with an adjusting structure, with the aid of which the rotary shaft 20 of a roller element 18, seen in plan view, can be adjusted with respect to the direction of operative travel A.

As can be seen from Figure 2, the rotary shaft 20 of the roller elements 18 is also placed at an angle α , which corresponds to the cone angle thereof, to a horizontal, and more specifically in such a manner that the lower line in the longitudinal direction of the circumference of the roller 4 extends in the horizontal direction. Figure 1 shows that the rotary shaft 20 can be positioned at a corresponding angle to the carrier 16 or, put differently, to a line transversely to the direction of operative travel A. To that end, the support 17 of a roller element 18 is provided with an adjusting structure 19. This structure 19 includes a horizontal disc 23 which is rigidly attached to the lower end of an upper support portion 22 and in which adjusting apertures 24 have been provided. The adjusting apertures 24 are arranged concentrically with respect to an imaginary axis of rotation of a lowermost supporting member 25. The lowermost supporting member 25 is disposed at the bottom side of the disc 23 via a flange 26 which bears on a supporting ring 27 that is connected to the disc. The supporting ring 27 is suspended from the disc by means of three bolts 28. Between the disc 23 and the supporting ring 27 there is an intermediate ring 29 which is also kept in position by the three bolts 28 and which is partly interrupted at the side facing the adjusting apertures 24. A lug 31 of the flange 26 of the lowermost supporting member 25 extends horizontally through the interruption in the intermediate ring 29. The flange 26 of the lowermost supporting member 25 is of a circular shape and is retained with an accurate fit by the intermediate ring 29. The lug 31 of the lower flange 26 is provided with an aperture, made at a distance which corresponds to the radial distance of the apertures 24 in the upper flange 23 with respect to the imaginary, vertical axis of rotation of the lower supporting member 25. A bolt or a locking pin can be inserted through this aperture to lock a roller element in one of the positions determined by the adjusting apertures 24. As is shown in Figure 1, when the bolt or locking pin is inserted in the centre adjusting aperture 24, a roller element is in a position in which the leading peripheral line of a roller element is at a square angle to the direction of operative travel. Using the remaining adjusting apertures 24, a roller element 18 can be adjusted from this centre position through an upwardly extending shaft through angles which correspond to half the cone angle α .

In the embodiment shown in Figures 1 to 3 of the roller, the roller elements 18 are open or, in other words, they are in the shape of a cage. In this embodiment, a roller element 18 is attached by means of a flange 33 placed at one end of the rotary shaft 20 against a flange 34 of a bearing housing 35. The bearing housing 35 is disposed on that end of the lower supporting member 25 that extends in the extension of the rotary shaft 20. The bearing housing 35 is locked by means of a locking nut 36 on the threaded free end of the supporting member 25. As is shown in Figure 4, an open roller element comprises eight rods 38 which define the circumference of the roller and are each positioned at the cone angle α, which amounts to 15°. The largest diameter of the circumference of a roller element 18 is 40 cms. At approximately one third of a rod length from the end of the largest roller circumference, each rod 38 is supported by a spoke 39 which radially extends from the rotary shaft 20 and is welded to the rotary shaft. That end of a rod 38 that is located near the smallest roller circumference is supported by a flange 40 which is provided at a square angle to the rotary shaft.

Figure 5 shows an embodiment of the roller, in accordance with the invention, comprising roller elements 42 which have a closed circumferential surface made of stainless plate steel. In accordance with the invention, instead thereof or in addition thereto, a different plate material, such as teflon, rubber or a hard plastics material, may alternatively be used. In this embodiment, a support 43 extends by means of one free end into the centre of the roller to beyond the lengthwise centre of the roller. A bearing housing is placed around this free end, which housing contains two facing, widely spaced-apart bearings 44. This bearing housing is provided with radially directed, plate-like triangular ribs for supporting the circumferential surface. The roller elements 42 of the invention as shown in Figure 5 are, for the sake of simplicity, not equipped with an adjusting device and, seen in plan view, are arranged in accordance with the embodiment shown in Figure 1.

Figures 6 to 8 show an embodiment of the machine in which cylindrically shaped roller elements 47, 48 are jointly adjustable about their upwardly directed supports 49. In such a construction, each of the two groups of roller elements 47, 48, which are formed by the mirror-inverted halves of the roller 4 as is shown in Figure 1 and described with reference thereto, can be adjusted with the aid of a single threaded spindle 50. To that end there is provided near a lateral end of the roller 4 the handle of the threaded spindle 50 which is arranged in the longitudinal direction next to the carrier 16 of the roller 4 and which extends to near the midway point of the roller 4. The threaded spindle 50 is attached to the carrier 16 via a holder 51. The threaded spindle 50 comprises a number of threaded bushings 52, each provided with a radially extending stub axle 53, which number is equal to the number of roller elements 47, 48. The roller elements are each pivotal about their upwardly directed support 49, which is passed through a fitting, upwardly directed aperture in the carrier 16. Near the upper end of a support 49 there is rigidly disposed a lever 54 which with a fitting aperture is provided such that it is pivotal about the stub axle 53 of the threaded bushing 52. This connection is locked by means of a locking pin which is not further shown in the drawings. The support 49 of a roller element in accordance with the construction shown in Figures 6 to 8 further includes a forked member 55, between whose legs the rotary shaft 56 of a roller element 47, 48 is fastened. Disposed between the forked member 55 and the carrier 16 and around the support 49 there is a spacer element in the form of a strong supporting spring 46, which pushes against the carrier 16 via a ring 57. Any compression of the spring 46 can be absorbed by the amount of clearance in the construction. As can be seen from Figures 6 and 7, the roller elements 18 can be very narrow, e.g. 7 cms wide, and are interspaced by 12 cms. The roller elements in accordance with the construction shown in Figure 8 have a width of approximately 43 cms and a mutual spacing of approximately 45 cms. For the purpose of an advantageous development on the soil the roller elements 47, 48 have rounded-off corners. The working width of the roller shown in Figure 1 is 3 metres.

The mode of operation of the rollers in accordance with the above-described construction is based on the friction with the soil which rollers of this type experience due to their oblique position relative to a line transverse to the direction of operative travel A. This friction ensures that earth does not stick to the roller, so that scrapers are no longer required. The roller elements 18, 42, 47, 48 are each disposed in groups of mirror-inverted halves of the roller 4 so as to render it possible to maintain a stable travel of the roller 4. Since the circumferential speed near the end having the small diameter exceeds that near the other end, there is as it were question of a driving portion and a driven portion of a roller element. Because of this drive mode, a conical roller element has an active pulverizing effect In all the said embodiments, a roller element remains relatively free from clogging earth and the roller has an adequate pulverizing and soil-compacting effect.

The invention is not limited to the features described in the foregoing, but also relates to all the details shown in the drawings. The invention further relates to all kinds of alternatives in the

construction, of course falling within the scope of the accompanying claims.

Claims

1. A soil cultivating machine (2) comprising a frame (8), soil working members and a roller (4) which extends through approximately the full working width of the machine, characterized in that the roller (4) is assembled from a plurality of elements (18) of a length which is considerably less than half the length of the roller (4), and which elements (18) are rotatable about a shaft (20) which is arranged at an angle to the longitudinal direction of the roller.

2. A soil cultivating machine as claimed in claim 1, characterized in that one or more roller elements (18) are mounted adjustably and lockably about an upwardly directed axis.

3. A soil cultivating machine comprising a frame, soil working members and a roller which extends through approximately the full working width of the machine, characterized in that the roller is assembled from a plurality of separate roller elements, which are mounted adjustably and lockably about an upwardly directed axis.

4. A soil cultivating machine as claimed in one or more of the preceding claims, characterized in that the roller (4) has a circumferential surface made of plate material.

5. A soil cultivating machine as claimed in one or more of the preceding claims, characterized in that the roller (4) has a circumferential surface which is predominantly formed by rod-like elements (38).

6. A soil cultivating machine as claimed in one or more of the preceding claims, characterized in that the roller elements (18) are in the shape of a truncated cone.

7. A soil cultivating machine as claimed in one or more of the preceding claims, characterized in that, seen in plan view, the roller elements (18) each have a leading circumferential line which extends transversely to the direction of operative travel A of the machine.

8. A soil cultivating machine as claimed in one or more of the preceding claims, characterized in that the roller elements (18) are rotatable about approximately horizontally extending shafts (56), in that the roller (4) is freely rotatable and has a diameter of approximately 40 cms, and in that two or more roller elements (18) are jointly adjustable.

9. A soil cultivating machine as claimed in one or more of the preceding claims, characterized in that, at least in operation, the machine is supported at least partly by the roller (4).

10. A soil cultivating machine as claimed in one or more of the preceding claims, characterized in that, in operation, the roller (4) pulverizes the top layer of the soil.

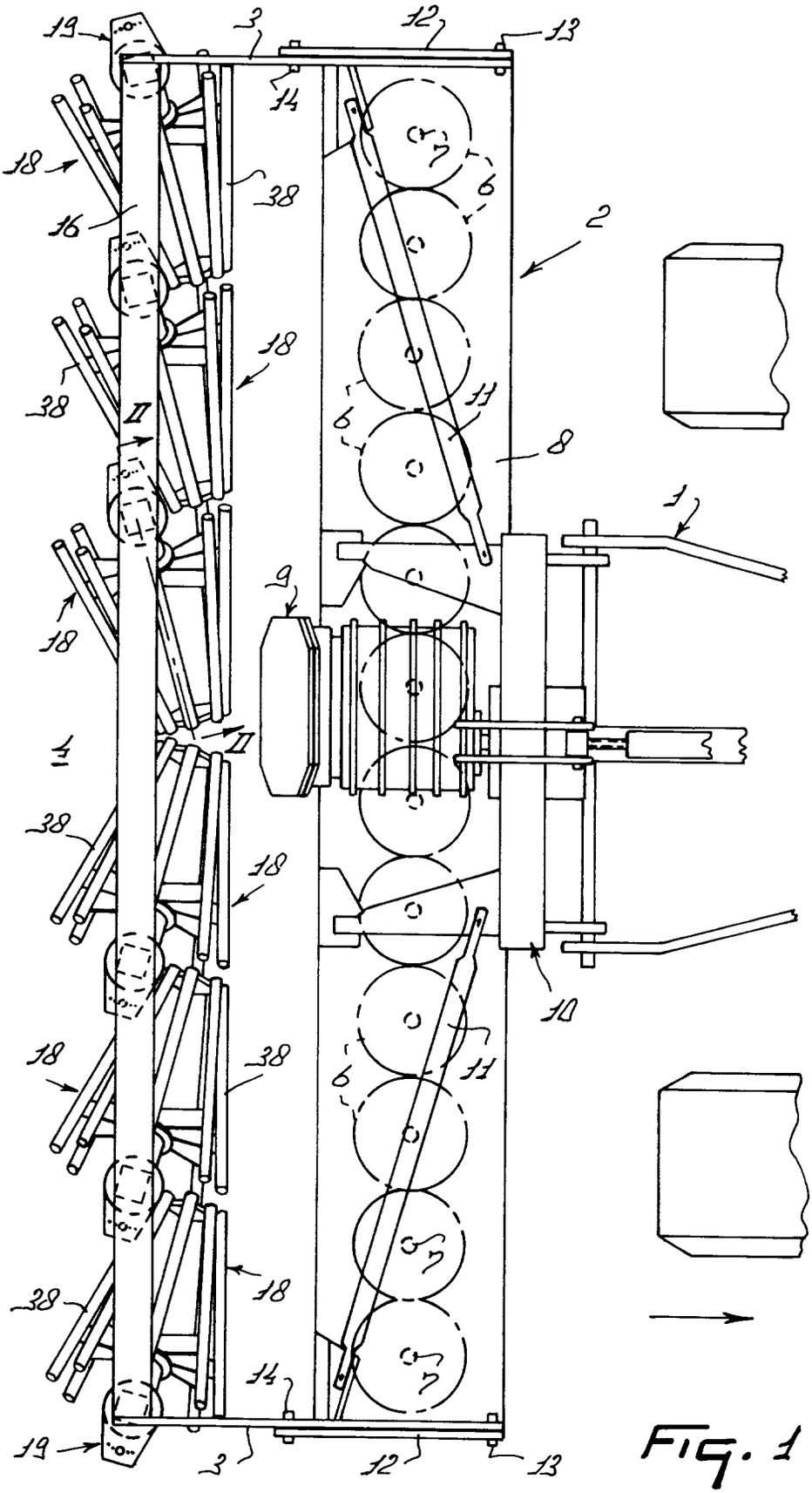

FIG. 1

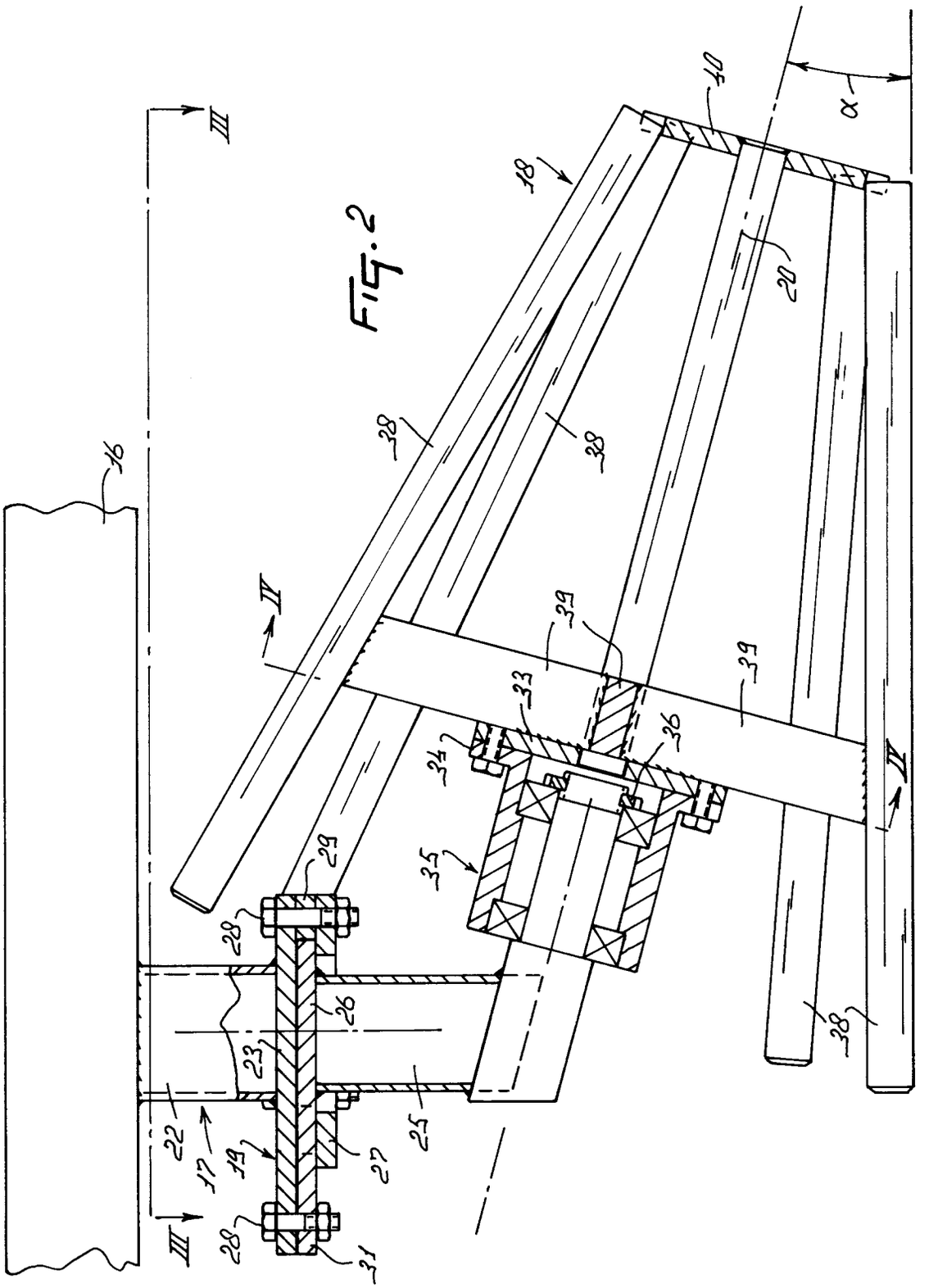
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FIG. 2

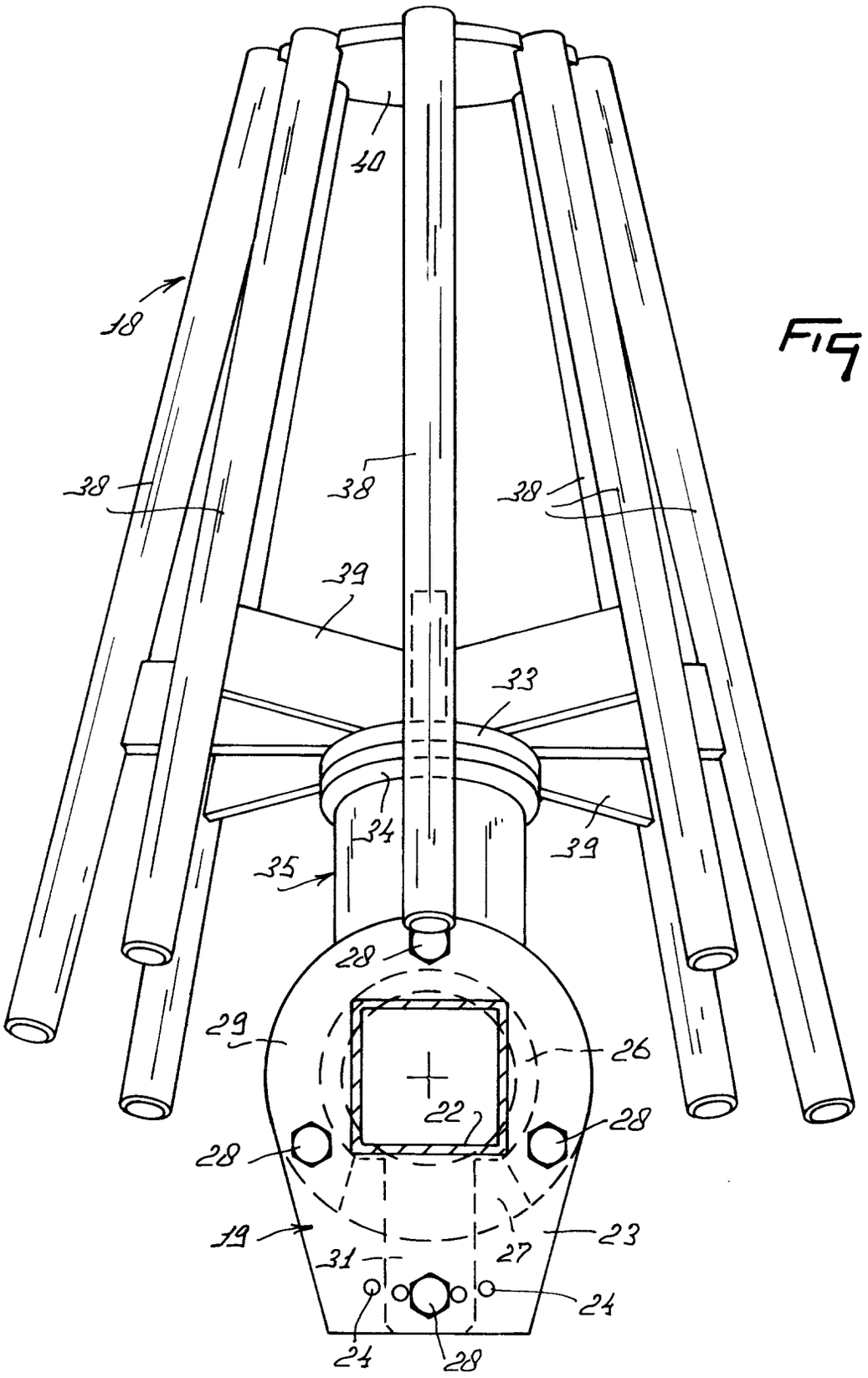

FIG. 3

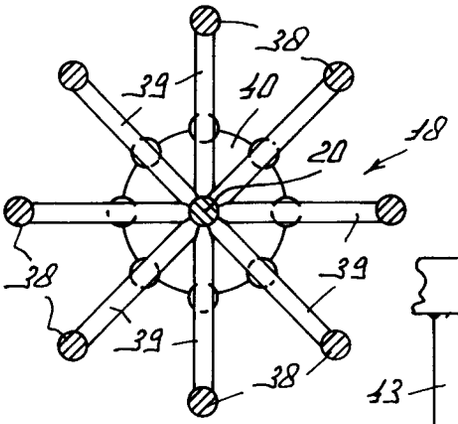

FIG. 4

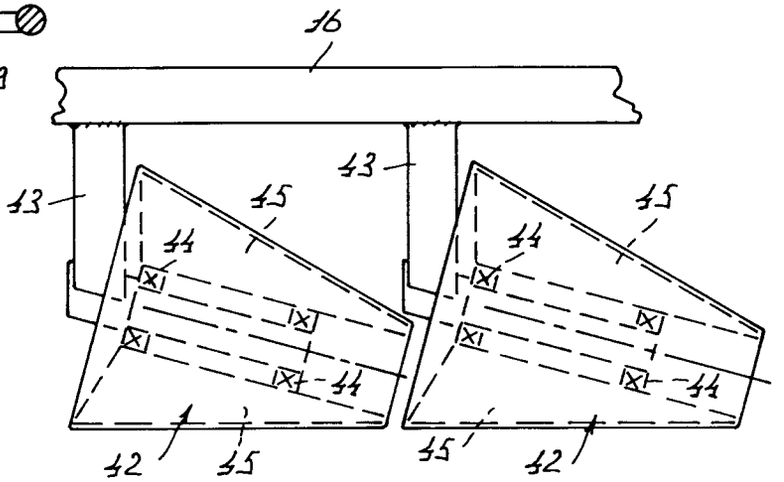

FIG. 5

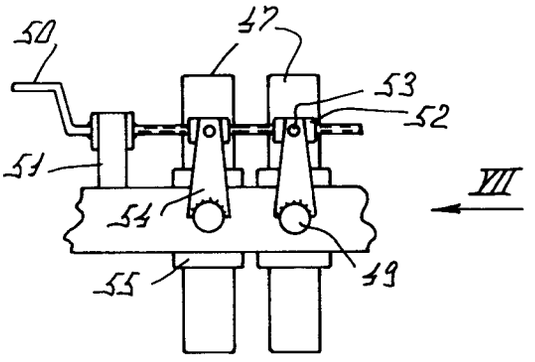

FIG. 6

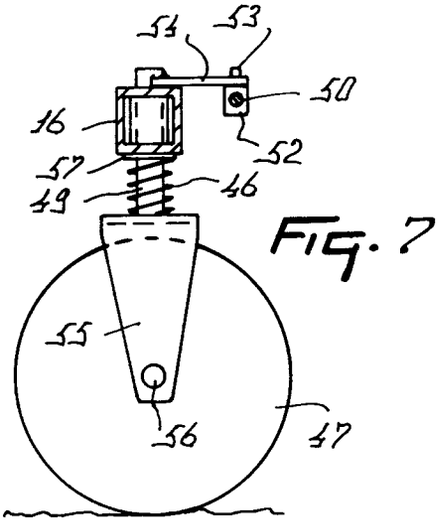

FIG. 7

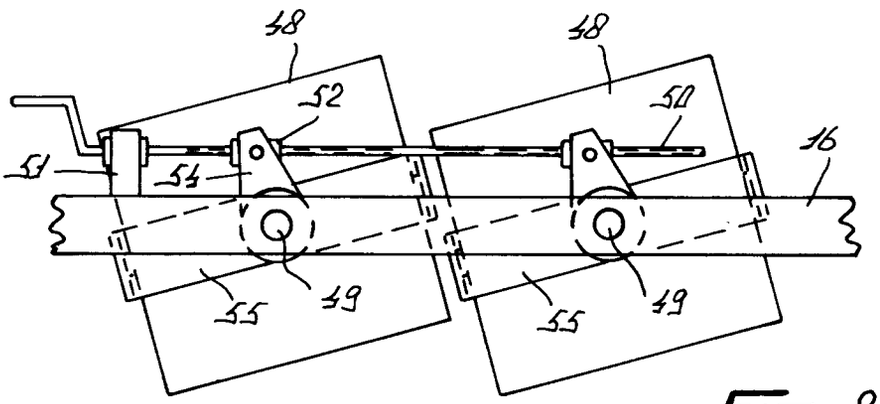

FIG. 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 20 1243

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	FR-A-2 015 081 (C. VAN DER LELY N.V.) * page 2, line 10 - line 38; figure 1 * * page 3, line 28 - page 4, line 18; figures 4-6 * * page 8, line 16 - page 9, line 5; figure 17 *	1-5,7,10	A01B29/04
X	DE-A-34 25 194 (BÜTTNER) * page 6, line 6 - line 23; figure 1 * * abstract *	1-3,7-10	
Y		6	
Y	DATABASE WPI Section PQ, Week 8539, 8 November 1985 Derwent Publications Ltd., London, GB; Class P11, AN 241566 LIQ FERTILISERS RES 'SOIL CULTIVATION ROLLER' & SU-A-1 144 635 (15 03 85) * abstract *	6	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

A01B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	2 August 1994	Eccetto, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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